Inequality, Redistribution and Rent-Seeking

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June 28, 1999

Abstract
We study the determination of redistributive policies in a political economy model with rent-seeking and political influence. In contrast to traditional models, a mean preserving spread can lower the effective redistributive tax rate. If rent-seeking is the main hindrance to growth, the model can account for the empirically observed inverse relationship between inequality and growth.

"Civil Government, so far as it is instituted for the security of property, is in reality instituted for the defence of the rich against the poor, or of those who have some property against those who have none at all."

Wealth of Nations, V.i.b.

1 Introduction

Is redistribution greater in more unequal societies?

Casual observation seems to answer this question in the negative. The most unequal countries of the world, such as Brazil and South Africa, do not spring to mind when one thinks up examples of large welfare states. Even among countries that have similar levels of income, the contrast between the United States' late development of welfare state institutions *vis-à-vis* Europe suggests that more unequal societies tend to redistribute less.

More careful empirical analysis has consistently confirmed these casual inferences. Benabou (1996) surveys the cross-country evidence linking inequality and redistribution and lists ten studies out of which nine failed to uncover a consistently significant relationship of any sign between these variables[1]. Perotti (1996) regresses six indicators of redistribution on inequality and finds very little pattern in their relation, regardless of whether the sample is restricted to democracies or not. Rodríguez (1999b) finds no evidence of a link between inequality and redistribution in cross-state regressions using higher quality US data. In fact, Pineda and Rodríguez (1999)

[1] The tenth study (Lindert 1996) finds a consistently negative relationship between inequality and redistribution among OECD economies. This negative link between inequality and redistribution for OECD economies has been confirmed by Rodríguez (1998), who does point out that the finding is somewhat sensitive to the sample of countries used.

have found a strong negative association between redistribution and capital's share of GDP.[2]

Despite this preponderance of evidence to the contrary, existing theories of the political economy of redistribution point in the direction of a positive association between inequality and redistribution. In traditional models, built on the assumption of well-functioning democratic systems, [3] inequality creates redistributive pressures that even in non-democratic countries translate into more redistributive policies. As inequality increases and the median voter becomes poorer, her incentives to vote for redistribution also increase, leading her to choose higher levels of transfers.

Our paper will attempt to bridge this disagreement between data and theory by presenting a model of politics in which there can be a negative association between inequality and redistribution. The channel we will appeal to is that of political influence. In our model increased inequality is synonymous with a transfer of economic resources from poor to rich. If such a transfer results in increased access to political power by the rich, then it will also result in a reduction in the capacity of the poor

[2] As Pineda and Rodríguez point out, there are good reasons to believe that capital's share of GDP may be a superior indicator of income inequality than indicators derived from existing income distribution data. These authors argue that, whereas income inequality data is often drawn from studies of questionable comparability, the standardization of the UN System of National Accounts makes capital shares highly comparable. They do, however, warn that the correlation between Gini coefficients and capital's share of income after controlling for GDP is quite low.

[3] Meltzer and Richard (1981), Alesina and Rodrik (1994), Persson and Tabellini (1994)

to control the political system. The end result will be a reduction in the average tax burden that the poor can impose on the rich and a more regressive tax system. The process through which this occurs is set out in the following pages, where we describe how individuals bargain over tax favors with policymakers who use political contributions to buttress their political power. Voters are not naive, though: they perfectly understand the workings of the political process and react to it. Precisely for this reason, they will decide to keep taxes low so as to control the incentives for rent-seeking.

Recent theoretical work which attempts to explain the positive empirical association between inequality and growth has relied on the presumed existence of a positive link between inequality and redistribution (Alesina and Rodrik, 1994, Persson and Tabellini, 1994). In those models inequality raises redistribution; redistribution in turn generates disincentives for capital accumulation and growth. In this paper we show that our model, in which inequality is negatively associated to redistribution, can provide an alternative explanation for why inequality is harmful for growth. In our model increased inequality, which enhances the political power of the rich, also increases the amount of resources deviated from productive activities into directly unproductive rent-seeking activities. By taking away resources which otherwise could have been invested, increased rent-seeking harms capital accumulation and growth.

An alternative way to pose the question of the relationship between inequality and redistribution is by asking why it is that in democratic capitalist societies, in which political rights are equally distributed but economic rewards are not, the losers from the economic process do not decide to expropriate the winners. This is a question which has puzzled economists and political thinkers for ages, and which led a number of eighteenth and nineteenth century political economists to consider restriction of the franchise to property owners a necessary evil without which capitalism would fall apart. In the minds of the likes of David Ricardo and Benjamin Constant, capitalism and democracy were incompatible.[4] An alternative point of view can be traced back to Alexis de Tocqueville (1835), whose comments on early American political arrangements point at the relationship between the extension of the franchise and the proportion of the electorate favoring redistribution. Meltzer and Richard (1981) coupled Tocqueville's insightful intuition with the observation that rational voters could understand how wholesale expropriation of the rich would destroy incentives for capital accumulation and thus work against voters' interests. They formulated a formal model of voting over redistribution, in which they established that tax rates in political equilibrium would be kept well below expropriation levels and that there would be an increasing relationship between inequality and redistribution, as more unequal societies are characterized by higher incentives for the median voter to support highly

[4]For example, Ricardo argued that suffrage should only be extended 'to that part of them [the people] which cannot be supposed to have an interest in overturning the right to property' . (Ricardo, 1818 [1951])

redistributive policies.

If the question is posed as one of why the poor do not expropriate the rich in democracies, then our explanation is that they do not do so because they cannot do so. The rich have access to political power which allows then to insulate themselves from redistributive pressures. A nominal tax rate of unity would generate such perverse incentives for policymakers to strike deals with the wealthy that it would be against the interests of predominantly poor voters to set it so high. Voters understand this power and set tax rates low enough so as to keep the incentives for rent-seeking under control. Better low taxes that are paid than high taxes that are not.

In our model, the power of the rich is not predicated on an unexplained hegemony of the ruling class nor on the absence of free-rider considerations. Rather, we study a game in which each wealthy individual cannot affect the overall redistributive tax rate but rather bargains over personalized tax favors with the policymaker. It is the uncoordinated actions of all wealthy individuals that sum up to a whole in which the rich have the power to partially thwart the redistributive efforts of the poor. In this sense, we provide a microfoundations for the claim that economic power is political power that is not open to the charge of being a functional explanation[5].

[5]Functional explanations predicate that social mechanisms originate as a result of the need of collectives to fulfill needs. This type of explanation, closely associated with nineteenth century sociology and marxism, was harshly criticized by Popper (1962). See also the discussion by Elster (1983)

Our model emerges from the confluence of three types of theories of redistribution. In building a model in which rational actors vote over redistributive policies we follow the contributions of Downs (1957) as applied to the positive analysis of the size of government by Meltzer and Richard (1981,1983) and integrated into theories of economic growth by Alesina and Rodrik (1991,1994), Persson and Tabellini (1992) and Perotti (1993). In taking into account the effect on political equilibrium of interest groups we borrow from a different and equally important literature pioneered by Becker (1983) and Peltzman (1976) and later advanced by Austen-Smith(1994), Baron (1987) Grossman and Helpman (1996) and Grossman, Dixit and Helpman (1996). And by formalizing the claim that economic and political power are correlated, our model borrows from the political theory literature on the state initiated by Marx and Engels's (1848) statement that under capitalism "the executive of the modern State is but a committee for managing the common affairs of the whole bourgeoisie," a lead that was followed by various generations of mostly, although not exclusively, Marxist and radical researchers[6].

In Section 2 we present our model in detail. It consists of a simple game between voters, politicians, and capitalists. We derive our basic result that greater inequality leads to less redistribution under a general functional form for the distribution of

[6]See Baran and Sweezy (1996), Poulantzas (1975), Milliband (1969), Offe (1984), Skocpol (1979), Domhoff (1967), Habermas (1975), Jessop (1990), and Resnick and Wolff (1987).

income as well as under specific empirically plausible specifications. We also provide microfoundations for our key assumption, the existence of increasing returns in political influence. Section 3 incorporates our model into a simple two-period model of capital accumulation. We show that when the effects of rent-seeking on capital accumulation are taken into account, inequality can lead to lower growth via increased rent-seeking by richer capitalists eager to escape taxes. We furthermore establish that the main results of our model are maintained when we design the tax-cum-subsidy scheme to be incentive compatible. Section 4 concludes.

2 A Model of Redistribution and Political Influence

2.1 The Basic Model

In this section we present a model of political influence embedded within a median voter framework where redistribution is decreasing in inequality. Our model consists of a game played between voters, politicians and influence-seekers. In this game, politicians will strive to maximize political support by mixing popular policies with campaign spending. Campaign contributions are offered by individual capital owners, who in return receive tax exemptions from the government. These may but need not be interpreted literally as income tax exemptions; they could represent any mix of political favors which the government is in the position to give to campaign contributors. In what follows we will refer to *contributors* as those who give campaign contributions and *taxpayers* as those who pay taxes. Capitalists are assumed to be atomistic and therefore offer campaign contributions purely in return for privately appropriable favors. We therefore exclude any public good nature from the policies over which political influence is exerted. Voters are able to control the incentives under which politicians and capitalists bargain by setting the tax rate.

Individuals own endowments in labor and capital. We assume that labor endowment is equally distributed while capital income is unequally distributed. Therefore the inequality in capital endowments generates the observed inequality in income distribution. Given a wide definition of capital which allows for human capital, this division accords well with the fact that empirically asset wealth is more unequally distributed than labor wealth.[7] What is important for the purposes of this section, however, is simply that there are two assets, one of which is unequally distributed[8]. The capital-labor distinction will become important when we turn to capital accumulation in Section 3 .

We label as workers those individuals who have no capital income; those who do will be called capitalists. Thus there are two types of heterogeneity: that between capitalists who own capital and workers who lack it, and that among capitalists who

[7] See Wolff, 1994.

[8] We could thus alternatively use the labels "insider status" vs. "outsider status" , "monopolists" vs. "competitive firms", or any other subdivision which we believe to be at the root of income inequality.

own different amounts of capital. We assume that the mass of workers n_w is greater than n_k, the mass of capitalists, so that the median voter is a worker. Since empirically, most income inequality is generated by the upper tail of the income distribution, this assumption does not give up much descriptive power; it does in turn permit us to characterize equilibrium policies as the preferred policies of a representative worker, allowing for a tractable mathematical framework. Workers receive their wage w and a transfer from the government s. They also pay the linear income tax τ. Income of workers is thus:

$$Y_l = w(1-\tau) + s \tag{1}$$

In addition to their wage income, capitalists also derive income from their capital earnings. The income of capitalist i is:

$$\begin{aligned} Y_k^i &= (w + \rho K_i)(1 - \tau + \varepsilon_i) - C_i - C_0 && (2) \\ C_0 &= \left\{ \begin{array}{c} a \text{ if } C_i > 0 \\ \\ 0 \text{ otherwise} \end{array} \right\} && (3) \end{aligned}$$

where ρ is the rental rate on capital, τ is the tax rate, $\varepsilon_i \leq \tau$ is an individual-specific tax exemption[9], C_i is the contribution that individual i gives to the politician

[9] More generally, individuals would be split into sectors and the government would decide whether to grant an exemption to each sector. If members of that sector can arrange a set of optimal internal transfers then all our results below follow.

in power, and K_i is individual i's ownership of capital income. Thus heterogeneity among capitalists is captured by differences in their holdings of capital. No generality is lost by assuming that workers cannot make political contributions; as we shall see below, the minimum political contribution would always be inaccessible to a worker in equilibrium. Groups are assumed to be perfectly identifiable; we show in section 4.1 that none of our results are affected by incentive compatibility considerations.

The contributor is assumed to pay a fixed cost $C_0 = a$ whenever he gives a campaign contribution. This assumption is vital to the results below; as it captures the increasing returns in political activity necessary to generate a split between the poor and the rich in terms of political organization. There are two possible ways to justify the increasing returns assumption. On the one hand, one could think about a set of real world characteristics of political markets which are likely to generate increasing returns, such as the existence of significant transactions cost of lobbying, administrative costs of approving exemptions, large fixed costs of political organization, or effort costs of providing political favors. An alternative, perhaps more compelling, justification could be derived from the simple economics of collective action. A group of individuals organized in order to undertake collective action faces pervasive incentives for free-riding from each of its members. Controlling free riding is easier the more resources you have, both because the numbers necessary to achieve a certain scale of political organization are smaller, and because you have more resources to monitor free riders.[10] In section 2.2 we show that a model of endogenous political mobilization that takes these considerations into account is isomorphic to the specification in (3).

It is important to note that, whatever the theoretical justification, the assumption of increasing returns in political influence seems to be quite consistent with the empirical evidence. Lobbying for small-scale political favors is seldom observed, and there is substantial empirical evidence that the rich participate more in politics in developed countries, both as contributors of time and of money[11]. Statistical evidence is scantier for developing countries, but what there is confirms the existence of an increasing relation between political participation and levels of income[12], and numerous studies of political elites tend to show that they arise almost exclusively from privileged groups [13]. In most of what follows, we treat increasing returns in

[10] These points were first made by Olson (1965)

[11] Rosenstone and Hansen (1993) use data from nineteen National Election Studies to study political mobilization in the United States. Besides confirming the well-known finding that wealthy Americans are more likely than poor Americans to take part in political activities, they also find that "the prosperous are two and a half times more likely than the poor to attempt to influence how others vote and over ten times more likely to contribute money to campaigns." (pp. 43-4)

[12] Gaviria and Sedden (1998), Portes and Itzigsohn (1997).

[13] Bakewell (1997) points out that during the thirties "the whole [of Chile] was controlled by families who inhabited four square blocks in central Santiago." (p. 424) Payne (1988) describes Jamaican politics as "both elitist and authoritarian...led by the educated middle class, funded by local businessmen, and only involving the masses as voters, cheerleaders or recipients of patronage." (pp. 2-3). Other examples are in Baloyra and Martz (1979), Bauer (1975), and Dumont (1970).

political influence as a primitive of our model and analyze its effect on the relationship between inequality and redistribution.

We simplify by assuming that both individuals' utility is linear in consumption. Politicians, however, are assumed to maximize a utility function which is a weighted average of the median voter's utility and the total of campaign or political expenditures[14]:

$$U_{pol} = Y_l + \lambda\,\gamma \int_i C_i(\varepsilon_i|K_i)f(K_i)dK_i = w(1-\tau) + s + \lambda\,\gamma \int_i C_i(\varepsilon_i|K_i)f(K_i)dK_i \quad (4)$$

where we assume that $\lambda > 1$[15]. The first two terms are simply the median voter's utility, whereas the third term in (4) is the average contribution of capitalists weighed by the relative mass of capitalists to workers γ and by their political effectiveness λ. This type of specification is common and is meant to capture the intuition that both popular policies and money are required to win elections. Grossman and Helpman (1996) have used a similar equation in the context of a general menu-auction political

[14] C_i should be viewed broadly as any uses that contributors can make of their money to affect political outcomes. Even in non-democratic systems, political activity is usually costly and requires financial support.

[15] Otherwise the politicians will approve no tax exemptions in equilibrium since they care more about the workers' income than about their own.

game (of which our model is a special case) with politicians jockeying for the support of both informed an uninformed voters[16]. An alternative model by Austen-Smith (1994) shows when voters are risk averse and uncertain about candidates' stance on the issues politicians will find it optimal to deviate from the policies preferred by the median voter in order to attract campaign contributions. In Rodríguez (1998) we provide microfoundations for (4) by showing that maximization of this term will characterize equilibrium policies in the context of a game in which politicians compete for the votes of voters who are informed but uncertain about the underlying effectiveness of the candidates as policymakers[17].

The policymaker maximizes (4) subject to his budget constraint:

$$s = \tau w + \gamma \int_i (\tau - \varepsilon_i)(w + \rho K_i) dK_i \tag{5}$$

so that the transfer must be financed from taxes on workers and on capitalists. The government always has the possibility of choosing $C_i = 0$, $\varepsilon_i = 0$. Substituting the budget constraint in the Politician's utility function:

[16]They use a weighted average of national income and political contributions, whereas we use a weighted average of the median voter's utility and political contributions.

[17]An alternative jsutification of the Politician's Objective would take C to be pure bribes and λ to represent the average politician's preference for money as opposed to his need of maintaining some measure of political support. This may be a more adequate characterization for the political systems of some countries.

$$U_{pol} = \; w + \gamma \int_i (\tau - \varepsilon_i)(w + \rho K_i) dK_i + + \lambda\, \gamma \int_i C_i(\varepsilon_i|K_i) f(K_i) dK_i \tag{6}$$

We now go on to describe the time structure of the game. In $t = 1$, the median voter votes over a tax rate $\tau \in [0, 1]$, which is henceforth fixed. In $t = 2$, each individual enters a bargain with the policymaker over the level of the exemption $\varepsilon_i \in [0, \tau]$ set by the politician and the contribution $C_i \in R^+$ given by the capitalist.[18] We do not restrict the nature of this bargain but only assume that the politician and the capitalist reach an efficient bargain.[19]

Note that our model allows voters to control the overall tax rate but not the vector of exemption levels. This key assumption embodies the main feature of our model, which is that it allows for limited power in the hands of voters, whereas traditional median voter models of redistribution assume voters have total power to set policies. It is precisely by allowing voters to set one set of policies and letting politicians have leeway to set the rest that we introduce a deviation from the median voter framework. Our choice of policies is clearly intuitive: voters are assumed to have control over the

[18]The standard menu auction structure in which the principals (capitalists) propose a schedule of contributions $C_i(\varepsilon_i) : [0, 1] \rightarrow R^+$ and the agent (politician) then picks an exemption $\varepsilon_i \in [0, \tau]$ is a special case of our model. However, great part of the common agency problem disappears in our model since each capitalist does not care about the exemption levels gained by other capitalists.

[19]That is, a bargain such that the joint utilities of the capitalist and the politician are on their utility possibilities frontier.

tax rate, which is observable by all and is often a key issue in electoral campaigns. They lack control over the vector of exemptions $\boldsymbol{\varepsilon} = \{\varepsilon_1, ..., \varepsilon_n\}$, which are numerous and in reality close to unobservable, negotiated in political back rooms and exposed to public opinion only through scandals, often long after the gains are realized. In Rodríguez (1998) we discuss an alternative formulation of the game just presented which has a truly more dynamic framework. In it we argue that the same policies we will now derive will be generated by a game in which two politicians (taking contribution schedules $C_i(\varepsilon_i)$ as given) set τ and $\boldsymbol{\varepsilon}$ to maximize their probability of winning an election in which they use political contributions to pay for campaign spending and voters can only punish politicians in future elections conditional on the history of tax rates (and thus not conditional on the history of tax exemptions). We show that the equilibrium tax rates we will now derive in our simpler model will be Pareto superior to all symmetric equilibria that can be supported in the dynamic game for sensible restrictions on the form of the strategies played. Since the proof involves appealing to complex punishment strategies common in the game theory literature on repeated games, we specialize to the more tractable static model in the rest of the paper.

The other key assumption in the setup is that voters move first and politicians move second. Although this assumption is intuitively designed to capture the nature of the difference between the interventions of voters in the political landscape, which happen at discrete intervals, as opposed to those of political contributors, which happen in continuous time within the framework set by voters' decisions, it is actually irrelevant to our results. The same results can be proven if we assume voters set the tax rate after politicians and contributors bargain on an exemption conditional on a rational expectation of the voters' decision[20].

Note that in our model the policymaker and contributor i bargain over ε_i but not over τ. This corresponds to an implicit assumption that free-rider problems are pervasive in bargaining over redistributive policies; therefore we should not commonly observe bargains in which money contributions are exchanged for redistributive policies that have direct effects on all individuals in society. Indeed, one characteristic of modern day redistributive policies is that political institutions do not commonly allow participation in redistributive schemes to be conditioned on participation in a political group[21]. In Olson's (1965) language, it is not possible to provide selective incentives to those that participate in political action targeted towards altering redistributive institutions. This fact combined with the sheer numbers of persons among whom the gains (in terms of welfare state transfers) and costs (in terms of taxes on

[20]Voters' ex ante optimal tax rate is, however, time inconsistent. Rodríguez (1998) discusses the effects of introducing time inconsistency into our framework.

[21]Some papers in the literature on redistributive politics (Dixit and Londregan, 1995) center precisely on selective transfers to small groups. Our paper is concerned however with redistribution understood as transfers from richer to poorer sectors of society.

the rich) are spread out imply that we should not expect to see large groups organize in order to exert pressure to favor different redistributive policies. Rather we should expect, as in our model, small very compact groups of individuals assemble to gain targeted tax favors, withand the rest of individuals exerting pressure through their right to vote[22].

We are now ready to solve the model backwards. The first step is to solve for the set of efficient bargains that can be reached between each capitalist and the politician in $t = 2$. This is done in

Proposition 1 *Any efficient bargain between capitalist i and the politician will be characterized by exemption levels*

$$\begin{aligned} \varepsilon_i &= \tau \text{ } \textit{if} \text{ } w + \rho K_i \geq \frac{a\lambda}{(\lambda - 1)\tau} \\ \varepsilon_i &= 0 \text{ } \textit{otherwise} \end{aligned} \tag{7}$$

Proof. *See Appendix.*

[22]It could be argued that labor union federations represent precisely the type of broad-ranging associations that exert pressure in favor of universal transfers and which our model assumes away. However, labor union federations are relatively unimportant contributors to political campaigns in terms of money contributions. To the extent that their main bargaining strength is in the votes of their participants, their influence is captured by the weight which the (wage earning) median voter's utility has in the politician's utility.

Therefore the distribution of taxes paid will be as follows: Capitalists with $(w + \rho K_i) > \frac{a\lambda}{\tau(\lambda-1)}$ will get an exemption for the total value of their taxes, and therefore pay zero taxes. Those with $(w + \rho K_i) < \frac{a\lambda}{\tau(\lambda-1)}$ will give no contributions, get no exemptions, and therefore pay the fraction τ of their incomes specified by law as taxes[23]. The reason for this is that when a capitalist's income is lower than $\frac{a\lambda}{\tau(\lambda-1)}$ it does not pay for her to offer to the politician the minimum bargain that would keep him at least indifferent between giving the exemption and collecting the taxes. This of course comes out of the assumption of increasing returns to scale in political activity. But when the capitalist's income is higher than $\frac{a\lambda}{\tau(\lambda-1)}$, there is scope for a bargain between the capitalist and the politician that leaves both at least as well off. Since the politician has a constant marginal cost of raising the level of the exemptions and the capitalist's utility is linear in ε_i once the fixed cost has been paid, then both individuals can gain from setting the exemption to its maximum level, τ given their decision to strike a bargain.

Using this result, we solve the model in $t = 1$. Using (7), we can write the total per capita transfer to be received by workers from the government as:

[23]The distribution of contributions is subject to the choice among efficient bargains. If the capitalist is able to extract all surplus from the politician, he will pay $C_i = \frac{(w+\rho K_i)\tau}{\lambda}$, the minimum he needs to make the politician content to carry out the policy. If the politician captures the surplus, then the capitalist's contribution will be $-a + (w + \rho K_i)\tau$.

$$s = \gamma \int_0^{\left(\frac{a\lambda}{\tau(\lambda-1)}-w\right)\frac{1}{\rho}} \tau(w+\rho K_i)f(K_i)dK + \tau w \tag{8}$$

Substituting in (1), we find that workers' utility will be:

$$U_w = w + \gamma \int_0^{\left(\frac{a\lambda}{\tau(\lambda-1)}-w\right)\frac{1}{\rho}} \tau(w+\rho K_i)f(K_i)dK \tag{9}$$

voters will set τ to maximize the net resource transfer from capitalists

$$r = \int_w^{\frac{a\lambda}{\tau(\lambda-1)}} \tau y_i f(y_i)dy \tag{10}$$

where we have written the income distribution among capitalists in terms of $Y = w + \rho K_i \sim f(Y)$[24].

Equation (10) captures the main trade-off facing the median voter in our model. Voters want to set the tax rate to maximize the net resource transfer received from capitalists. If they raise the tax rate they will raise r by$\left(\int_w^{\frac{a\lambda}{\tau(\lambda-1)}} y_i f(y_i)dy\right) d\tau$, as all capitalist taxpayers will now have to pay a higher tax rate. But a higher tax rate raises the incentives for rent seeking and makes the number of capitalists who give political contributions in exchange for tax favors go up. This is captured by the negative effect of τ on the upper limit of the integral defining r,$\frac{a\lambda}{\tau(\lambda-1)}$. If the possibility for evading taxes through political contributions did not exist, only the

[24]We abuse notation by writing $f(y)$ which is a distinct density from $f(k_i)$. The change of variable rule implies that $f(y_i) = \frac{f(k_i)}{\rho}$.

first effect would operate and therefore voters would set a tax rate of 1. But the fact that this may lead to a level of rent seeking that would create massive tax evasion makes voters keep the tax rate limited. Thus voters may in equilibrium set a tax rate lower than 1 even absent incentive considerations[25].

The central contention of our paper is that in a model that takes into account how an inegalitarian distribution of income enhances the political power of the richer sectors of society, inequality will be negatively associated with redistribution. As our main indicator of redistribution we center on the *effective tax rate on capitalists*, $r' = \frac{r}{\mu_k}$, which measures what percentage of the income of capitalists is being taxed. This contrasts with τ, the *nominal tax rate on capitalists*, which in traditional models is equal to r'. In our model τ and r' will generally have different comparative statics. Between these r' is of course the variable of normative significance as a measure of

[25]They may but they need not. It is perfectly possible theoretically for the minimum possible threshold level of income $y^*_{\min} = \frac{a\lambda}{(\lambda-1)}$ to be so high that the gains to voters from keeping the tax rate low are simply not enough to encite them to maintain their tax rates restricted. In this case, voters would decide to set a tax rate of unity so as to "milk" those capitalists who would never be able to buy into political influence. In other words, most income is in the hands of people who have no choice other than to pay taxes, and it would imply great sacrifice in terms of tax revenues to lower the tax rate to a level consistent with the really rich paying taxes. Note that even when voters set a tax rate of unity the effective tax rate on capital income $r' = \frac{r}{\mu_k}$ will be less than unity. As a matter of fact, $\tau = 1$ is more an expression of the powerlessness of voters to capture income accumulated in the higher ends of the scale than anything else.

redistribution, as it measures what percentage of their income an individual capitalist is required to surrender to the state. We will also concentrate on the Tax/GDP ratio, and the Transfer/GDP ratio.

To analyze the effect of changes in income distribution on r', we will write the density function of income as $f(y, \sigma)$ and look for the change in r' caused by a change in σ, the parameter (or vector of parameters) that captures inequality of income distribution. By the envelope theorem:

$$\frac{dr}{d\sigma} = \frac{\partial r}{\partial \tau}\frac{\partial \tau}{\partial \sigma} + \frac{\partial r}{\partial \sigma} = \frac{\partial r}{\partial \sigma} \tag{11}$$

Equation (11) tells us that we need only look at the partial effects of the changes in income inequality on the net resource transfer when assessing perturbations to equilibria and can disregard the effects that go through changes in τ, as these will be of second order magnitude. Armed with this result, we can go on to establish some comparative statics effects of inequality on income distribution.

Proposition 2 *(i) A mean preserving transfer of income between capitalists with income below* $y^* = \frac{a\lambda}{\tau(\lambda-1)}$ *and capitalists with income above* y^* *will lower* r'*; an identical transfer in the opposite direction will raise* r'*.*

(ii) A transfer of income from workers to capitalists which leaves the distribution of income among capitalists untouched will lower r'*; a similar transfer from capitalists to workers will raise* r'*. (See appendix 2 for proof).*

Proposition 2 characterizes an important class of transfers from poor to rich individuals which will worsen redistribution. Transfers of income from sufficiently poor individuals to sufficiently rich individuals will unequivocally lower r'. This result establishes a strong link between a class of inequality-raising transfers and redistribution in our model. Indeed, responsiveness of inequality indices to poor-to-rich transfers has long been argued for as a minimal condition for inequality indices in traditional welfare economics[26].

It is not the case, however, that *all* poor-to-rich transfers will lower r'. To see this, suppose that a mass of individuals with income just above y^* transfers its income to individuals richer than them, thus seeing their own income fall below y^*. In that case the deterioration in income distribution makes a group of individuals fall below the threshold which separates political contributors from taxpayers, thereby raising the amount of income that is taxable at the initial equilibrium. The possibility of such effects is governed by the magnitude of the income transfer received by an individual at the threshold y^*[27]. It is easy to prove that if individuals with threshold income y^* are not affected, a transfer from poor to rich capitalists will unequivocally deteriorate redistribution.

[26] Known statements of this principle go back at least as early as the 1910s, when it was first proposed by A. Pigou and H. Dalton. See Pigou (1912), Dalton (1920), Sen (1973)

[27] From equation (36) in the Appendix one can see that such effects are totally due to the effect of the transfer on the threshold individual, $a(y, \sigma)$.

In order to get more specific results, we will need to restrict the functional form of $f(K)$. In the following examples we work through two examples of our model using the uniform and the Pareto distribution for $f(K)$. The former is of illustrative interest, whereas the latter is of greater empirical relevance. We derive the result that under these two cases, greater inequality will lower the equilibrium r'.

Example 1 *Let Capitalists' income y_k^i be distributed with uniform density over $[w, w + r\overline{K}]$. That is:*

$$\begin{aligned} f(y_k^i) &= \frac{1}{r\overline{K}} \text{ for } Y_k^i \in [w, w + r\overline{K}] \\ & \quad 0 \text{ otherwise} \end{aligned}$$

then the nominal tax rate τ, the net tax rate on capital $r' = \frac{r}{n_k \mu_k}$, the Tax/GDP ratio and the Transfer/GDP ratio are all declining in the variance of income, the Gini coefficient of the income distribution, the mean/median income ratios, and capital's share of income. (See Appendix for details.)

The uniform density is an interesting benchmark but is clearly not a realistic description of income distribution among capitalists. A realistic functional form for the distribution of income among capitalists would ideally be a good empirical description of income distribution among the richer individuals in society. This is because the distribution of income $f(y)$ which goes into (10) is the distribution of income *among* capitalists, who in our model comprise less than 50% of the population. The empirical literature in income distribution estimation has shown that the Pareto density appears to accurately describe income distributions along their upper tail[28]. We illustrate this case in the following example:

Example 2 *Capitalists' income* y_k^i *is distributed according to a Pareto density* $P(\alpha, w)$*:.*

$$f(y) = \alpha w^{\alpha} y^{-\alpha-1} \text{ for } y > w$$
$$0 \text{ otherwise}$$

Then net tax rate on capital $r' = \frac{r}{n_k \mu_k}$*, the Tax/GDP ratio and the Transfer/GDP ratio are all declining in the variance of income, the Gini coefficient of the income distribution, the mean/median income ratio and capital's share of income. The nominal tax rate* τ *has a unique interior minimum and is therefore declining in inequality at low levels and increasing at high levels of inequality. (See Appendix for details.)*

[28]See Lambert (1989) and Harrison (1981). The Pareto density has been found to be superior to the lognormal distribution in describing the upper tail of the income distributiion. The lognormal distribution is often used in theoretical work on income inequality, as in Benabou (1996), because it captures adequately the negative skewness of income distributions. That skewness is captured in our model by the fact that in our specification at least a half of the population receives an income equal to w, lower than that received by any capitalist.

As in the uniform distribution, more inequality leads to less redistribution. Increases in inequality are equivalent to shifts of resources from the poor to the rich. If resources are shifted from people below the threshold level of income (the taxpayers) to people above the threshold level of income (the tax-exempt) then at the original tax rate total taxes collected will decrease. Of course to understand the total effect of this increase in inequality on tax revenues we should understand how voters raise or lower the tax rate in response to the increase in inequality. But the envelope theorem result in (11) shows us that we can disregard the effect of voter's reoptimization, as this will be of a second order magnitude. We can concentrate on the first-order effects of an increase in inequality on taxes collected. We have established that this effect will always be negative.

Note that, unlike in the uniform case, the nominal tax rate is not monotonic in inequality . At low levels of inequality, higher inequality leads to a fall in the nominal tax rate. But as inequality becomes high enough, this effect changes and deteriorations in income distribution start leading to higher nominal tax rates. This effect is illustrated in Figure 2(c). This is in contrast to the uniform case [Figure 1(c)], where an increase in income inequality invariably brings about a fall in the nominal tax rate. Under the uniform distribution, a higher level of inequality leads voters to lower tax rates so as to not let the group of individuals with higher income have incentives to buy themselves tax exemptions. In the Pareto case, such an effect occurs at low levels of income inequality (at which the Pareto form is closest to the uniform distribution). But at high levels of income inequality, those in the higher income brackets see their possibilities for escaping taxation enhanced. The cost of giving these individuals incentives to not buy themselves tax exemptions by keeping low tax rates becomes too large. Rather than reduce taxation to control their incentives for rent-seeking, voters prefer to raise the tax rate and extract more resources from those whose income is too low to give campaign contributions. Thus one could say that at low levels of income inequality voters decide to pander to capitalists so that they will not have an incentive to go into rent-seeking activities, whereas when inequality becomes very high voters would rather try to milk lower-income capitalists by raising very high tax rates on them and letting the really rich capitalists escape taxation.

Insert Figures 1 and 2 here

The indeterminacy of the sign of $\frac{d\tau}{d\alpha}$ under the Pareto form suggests that empirical testing of hypotheses with respect to the relation between inequality and redistribution must be approached with care. To the extent that the indicators of redistribution used are measures of effective redistribution, then our theory implies a negative relationship between inequality and redistribution. But to the extent that these are indicators of the nominal tax rate gross of exemptions our theory would predict that there ought to be no linear relationship between these variables. Now if the exemptions of our model take the form of favors which are paid out of the government budget (such as government contracts to favored firms or government subsidies to politically friendly firms) then government spending would be analogous to the nominal tax rate in our model. Our results suggest that we concentrate on effective measures of redistribution, such as government transfers to the poor or spending on education and health, for understanding the effect of inequality on redistribution. They thus also recommend caution when interpreting standard results from cross-country regressions (such as those in Perotti (1996)) that find little effect of inequality on government spending.

2.2 Endogenous Political Mobilization

In the previous subsection we assumed that political influence was characterized by increasing returns. These increasing returns were captured by a fixed cost parameter a, which made it profitable to participate in political activity only for individuals with income higher than a threshold level of income $\frac{a\lambda}{\tau(\lambda-1)}$. In what follows we show that there is a natural way to endogenize these increasing returns in political influence from a model in which interest groups set their size to balance two effects of greater numbers. On the one hand, greater numbers mean greater capacity to raise money and therefore greater bargaining power vis-à-vis policymakers. On the other hand, greater numbers imply greater costs of controlling free-riding. Groups with higher income will have higher capacity to raise money and therefore will be in a better position to cover the costs of political organization. We show in what follows that whenever the cost of political mobilization is increasing, convex and homogeneous of degree r in the number of participants for any r, only groups above a certain threshold level of income will obtain exemptions (and will bargain for $\varepsilon_i = \tau$); groups below that threshold will not organize politically and will receive no exemptions. The division between contributors and non-contributors obtained from this more complex specification is therefore identical to that obtained using a simple fixed cost of political organization.

Our model of political mobilization as follows: Before bargaining with policymakers takes place, interest groups are formed. There is one interest group for each set of individuals of income y_i (including workers). Each group will be composed of n_{0i} individuals. They will bargain with the policymaker over exemptions and contributions in order to maximize the total surplus obtained for members of the group - they will not take into account the welfare of non-members of the group. However, an exemption obtained by a group will be valid for all individuals with their level of income (not just group members). The number of participants in the group will be set so as to maximize the total surplus obtained by group members (therefore there is an implicit assumption of lump-sum transfers between group members). This means that an interest group can exclude entrants if it believes that the entrants' contribution to the group will be smaller than its capacity of generating additional surplus for existing members. To control free riding by a group of n_{0i} individuals a group must expend resources $C(n_{0i})$. We assume $C(.)$ is increasing and convex.

We model the bargain between the policymaker and the capitalists as a generalized Nash bargain. Thus we will look for the sets of $\boldsymbol{\varepsilon}, \tau$ which simultaneously solve:

$$
\begin{aligned}
& \underset{\varepsilon_i, \tau}{Max} \left\{(1-\eta)\ln\left(n_{0i}y_i\varepsilon_i - C_i\right) + \eta \ln\left(-y_i\varepsilon_i + \lambda C_i\right)\right\} \\
s.t. \quad &: \quad 0 \leq \varepsilon_i \leq \tau, C_i \geq 0
\end{aligned}
$$

Note that this includes as polar cases the case in which capitalists capture all the surplus ($\eta = 0$) as well as when politicians capture all the surplus ($\eta = 1$). The symmetric Nash bargaining solution corresponds to $\eta = \frac{1}{2}$. Lemma 1 establishes the outcome of the bargaining process.

Lemma 1: The Nash bargaining solution for a group with n_{0i} members and the policymaker will be characterized by:

$$
\begin{aligned}
\varepsilon_i &= \tau \\
C_i &= \frac{1}{\lambda}\left[\eta(\lambda n_{0i} - 1) + 1\right] y_i \tau
\end{aligned}
$$

if $n_{0i} > \frac{1}{\lambda}$ and

$$\begin{aligned} \varepsilon_i &= 0 \\ C_i &= 0 \end{aligned}$$

otherwise.

Lemma 1 allows us to specify the indirect payoffs to interest groups of organizing:

$$\begin{aligned} V(.) &= n_{0i} y_i \tau - \frac{1}{\lambda}\left[\eta(\lambda n_{0i} - 1) + 1\right] y_i \tau - C(n_{0i}) \text{ if } n_{0i} > \frac{1}{\lambda} \\ & \quad -C(n_{0i}) \text{ otherwise} \end{aligned} \tag{12}$$

Using these payoffs, we can derive the conditions for there to be political organization as the conditions for the optimal n_{0i}, n_{0i}^* to be greater than $\frac{1}{\lambda}$ as well as for (12) to be greater than zero. Proposition (3) shows that for both conditions to be satisfied only individuals above a certain threshold level of income will organize politically and therefore obtain exemptions .

Proposition 3 *Let $C(.)$ be homogeneous of degree t . Then all groups with $y_i > T\frac{1}{\tau}$ will organize politically. The exemption and contribution levels that they will bargain for will be:*

$$\begin{aligned} \varepsilon_i &= \tau \\ C_i &= \frac{1}{\lambda}\left[\eta(\lambda n_{0i} - 1) + 1\right] y_i \tau \end{aligned} \tag{13}$$

All groups with $y_i < T\frac{1}{\tau}$ *will decide not to organize politically and therefore their outcome will be characterized by*

$$\begin{aligned} \varepsilon_i &= 0 \\ C_i &= 0 \end{aligned}$$

where $T = \left(\frac{(1-\eta)}{\lambda[(1-\eta)C'^{-1}((1-\eta))-C(C'^{-1}((1-\eta)))]}\right)^{t-1}$

Proof. *See Appendix* ■

Note that the threshold level of income is a constant multiplied by $\frac{1}{\tau}$. This is precisely the same functional form as the threshold we derived above for the case of a fixed cost. If we set the fixed cost $a = T\frac{\lambda-1}{\lambda}$ then the model in this subsection can be seen to be identical to the model with an exogenous fixed cost. Proposition 3 can therefore be seen as providing microfoundations for the increasing returns in political influence assumption.

2.3 Alternative Political Settings

How are these results above sensible to our specification of the political setting? In our political system voters control the tax rate and politicians control the level of exemptions. This assumption has allowed us to model a setting in which voters have limited control over policies. How would the results change as we go towards the extremes in which either voters or politicians control both the tax rate and the levels of exemptions? If voters were to control both variables, then we would be back in the setting of the pure median voter model. Results would be analogous to those of the Meltzer-Richard model in the absence of incentive considerations - voters would set taxes to 1 and exemptions to zero, therefore totally expropriating the wealth of richer individuals.

The other extreme is perhaps more interesting. What would happen if politicians were to control both variables? In this case, they would set the tax rate to maximize (6). This introduces an additional consideration in the determination of the equilibrium tax rate. Politicians will want to set tax rates higher than is desired by voters in order to raise their bargaining power vis-à-vis capitalists. Therefore $\frac{\partial r}{\partial \tau} \neq 0$ and the envelope theorem cannot be applied to establish (11). How this will affect the comparative statics effect of inequality on equilibrium redistribution will depend on the precise form of the bargain struck between politicians and capitalists. In the Appendix we show that for the two polar cases in which either capitalists or politicians capture the entire surplus of the bargain, as well as for all contribution schedules which are linear in τy_i[29], the nominal tax rate set by policymakers will be independent of the level of inequality. Therefore $\frac{\partial \tau}{\partial \sigma} = 0$ and (11) will continue to hold.

[29]The case of contribution schedulkes which are linear in τy_i includes as a special case all solutions to the generalized Nash bargaining problem described in 2.2.

3 Inequality, Redistribution and Capital Accumulation

We have established above that in our model increased inequality leads to more redistribution. Can our model be made consistent with the empirically observed negative relationship between inequality and growth? In this section we present a simple two-period model of capital accumulation which shows that, if the resources that go into political contributions are thereby not invested in productive capital accumulation, the increase in rent-seeking associated with increased inequality may take such a large chunk of resources from capital accumulation that it can end up harming economic growth.

The interaction between investment and political contributions requires a more specific description of the amount of transfers from capitalists to politicians. Proposition (1) and all the results that follow from it are independent of the form that this transfer takes, provided it is the outcome of an efficient bargain. No such generality is possible in the analysis of the interaction between rent-seeking and economic growth. In this section we restrict ourselves to the study of three special cases: (1) when capitalists capture all the surplus of the bargain between them and politicians and thus $C_i = \frac{w+\rho k_i}{\lambda}\tau$ (2) when politicians capture all the surplus and $C_i = (w + \rho k_i)\tau - a$, and (3) when the equilibrium contribution is linear in τy_i, as is the result in the generalized Nash bargain developed in section 2.2.[30]

[30] Note that if we follow the standard common agency setup in which capitalists offer a contribution

We look at a 2-period setting, in which capitalists decide in period 1 whether to invest or consume an endowment y_{i1} of resources which they are born with. They can either consume it in period 1 or invest it. If invested, they have the choice of either investing in productive capital, which earns a return of ρ [31] but is subject to a tax of τ,or alternatively of investing it in contributions to politicians. This investment has a cost of C_i. Its return is the value of the tax exemption that the capitalists will get in period 2 in return, τy_i. The waiting time between the moment in which the contribution is paid and the moment in which the exemption is given effectively makes the political contribution into an investment, forcing capitalists to decide whether to dedicate their limited resources to capital accumulation (k_i) or to political contributions (C_i). Note that the tax falls on endowments since in order to concentrate on the effect of rent-seeking on investment we assume away disincentive

schedule conditional on exemptions and the politicain decides whether to accept or reject their offer then capitalists will end up capturing all the surplus and we are in case (i). For general applications of this setup, see Bernheim and Whinston (1986) and Dixit, Grossman and Helpman (1997). Note also that our problem is different from standard common agency problems in one relevant sense, which is that the bids are over individual-specific policies rather than policies which affect everyone. Thus the setup in which contributors move first allows capitalists to capture all the surplus whereas in standard common agency problems it can effectively lead the politician to capture all the surplus (Proposition 5, Dixit, Grossman and Helpman (1997))

[31] We assume a linear technology or that the economy is open and the rate of return is therefore constant.

effects of taxation on capital accumulation. The tax falls on the capitalist's "full income" $y_i = w + \rho y_{i1}$. We assume that capitalists may go into debt, but the amount of debt is bounded above by a non-negativity restriction on each period's consumption. Therefore consumption in each period for capitalist i is given respectively by

$$\begin{aligned} d_1^i &= y_{i1} - k_i - C_i - C_0 \\ d_2^i &= (-\tau + \varepsilon_i) y_i + \rho k_i + w \\ d_1^i &\geq 0, d_2^i \geq 0 \end{aligned}$$

As long as $\rho > 1$, those who make no contributions will invest $k_i = y_{i1} = \frac{y_i - w}{\rho}$. Those who do make contributions will invest proportionately less, $y_{i1} - C_i - C_0$. Table 1 gives the level of contributions and capital accumulation that correspond to cases (1)-(3) described above.

TABLE 1

Case	C_i	$k_{i\mid y_i > y_i^*}$	$k_{i\mid y_i < y_i^*}$	K
(1)	$\frac{y_i}{\lambda}\tau$	$y_i(\frac{1}{\rho} - \frac{1}{\lambda})\tau - a - \frac{w}{\rho}$	y_{i1}	$\frac{1}{\rho}\begin{pmatrix} \mu_k \left[1 - \frac{1}{\lambda'}(\tau - r')\right] \\ -a'(1 - F(y^*)) - w \end{pmatrix}$
(2)	$y_i\tau - a$	$y_i(\frac{1}{\rho} - 1)\tau - \frac{w}{\rho}$	y_{i1}	$\frac{1}{\rho}\left(\mu_k \left[1 - (\tau - r')\right] - w\right)$
(3)	$q y_i \tau$	$y_i(\frac{1}{\rho} - 1)\tau - a - \frac{w}{\rho}$	y_{i1}	$\frac{1}{\rho}\begin{pmatrix} \mu_k \left[1 - q(\tau - r')\right] \\ -a'(1 - F(y^*))w \end{pmatrix}$

where $a' = a\rho$, $\lambda' = \lambda/\rho$, $y_i^* = \frac{a\lambda}{(\lambda-1)\tau}$.

The change in investment when inequality rises will depend on three factors: (i) inequality puts more resources in hands of capitalists, so that μ_k rises and w falls, leading to a rise in capital accumulation, (ii) as inequality rises the gap between the nominal and the effective tax rates $\tau - r'$ rises (see Appendix for proof), which causes capital accumulation to fall, and (iii) as inequality rises the amount of fixed costs expended in rent seeking $a(1 - F(X^*))$ goes up (see Appendix for proof), leading to lower capital accumulation in cases (1) and (3) Thus, even though an increase in inequality increases the proportion of income that is in capitalists' hands and can be invested, it also raises the amount of resources devoted to rent-seeking. The total effect of an increase in inequality on investment is a sum of these two effects and is therefore indeterminate. We have carried out a battery of computer simulations, not reported for reasons of space, that show that a negative effect of inequality on redistribution can commonly arise at least over some range of the distribution of income.

It is interesting to relate our model to some of the previous literature on inequality and growth. Before the emergence of median voter models of growth and distribution, the consensus among economists was that greater inequality would foster growth by raising the savings rate[32]. These classical models assumed, as we do, that capitalists

[32] Kaldor, 1960 , Kalecki, 1971, Marglin, 1984

were able to save and workers were not, so that a transfer of income from workers to capitalists would raise the overall savings rate of the economy. What we have established is that, within a framework in which capitalists are assumed to save more than workers, income inequality may raise the amount of resources devoted to rent-seeking activities so much that it may offset the classical effect and diminish classical accumulation.

The above result has been proved assuming non-distortionary taxation. Although this has served to isolate our effect, it is worth asking to what extent our results change when one takes into account the effects that higher tax rates may have on capital accumulation. When we introduce distortionary taxes we introduce an additional positive effect of inequality on capital accumulation. The reason is that inequality puts resources into the hands of those who have the capacity to buy themselves tax exemptions and who therefore face lower marginal tax rates and invest more. This effect is aggravated when governments have little capacity to commit themselves to less than optimal tax rates. In the limit, time inconsistency implies a capital levy on those who do not have the capacity to isolate themselves from taxation by buying off politicians. Investors below the threshold of resources necessary to enter into rent-seeking activities will, if certain they will be subjected to a capital levy, not invest. The only capitalists who will invest are those who are rich enough to pay off the politicians so that they will not be taxed. A shift of income into the hands of those capitalists will raise the rate of investment and growth[33].

Whether inequality has a negative effect on economic growth thus hinges on what is more important for capital accumulation: low tax rates or controlled rent-seeking and corruption. The empirical evidence showing a negative association between inequality and redistribution may suggest that the latter effect is more important than the former one, emphasized by the previous literature. So, perhaps, do the studies on corruption and economic performance in highly unequal developing countries, which describe societies characterized by massive systems of transfers from businesses to politicians (Bates, 1981, Klitgaard, 1988, Mauro, 1995). It is our contention that these systems have their primary origin in the very unequal distribution of income of these countries.

Our theory of inequality, rent-seeking and growth may shed light on some puzzles in economic history such as the vast differences in economic performance between North and South America, which at the beginning of the 19th century had similar levels of GNP per capita. Especially during the 19th century, the US's GDP per capita grew between four and six times while that of most Latin American countries stagnated[34]. Cultural explanations that rely on the differences in economic institutions inherited from their respective metropolis fail to account for the disappointing growth performance of the former British colonies of the Caribbean and South Amer-

[33] For further discussion of these results, see Rodríguez, 1998.

[34] Atack and Pasell, 1994, Haber, 1997.

ica. Explanations based on political instability have the challenge of accounting for the Brazilian experience, during which despite a 19th century without wars or internal disputes there was an average annualized growth rate of less than one-tenth of a percent from 1820 to 1900.

Recent research in economic history (Engerman and Sokoloff, 1997) has argued that inequality was at the root of the differences in economic performance between the Northern and Southern halves of the Western Hemisphere. Numerous case studies have documented the power of landed elites in nineteenth century Latin America and how it put severe limits on the ability of the political system to enact fiscal and economic reforms that would have created a sufficiently high tax base and well-defined property rights. Without these reforms, Latin America was unable to fund the investments in infrastructure, public goods and human capital accumulation which were key for economic growth during the nineteenth century. [35]

[35] Studies of the political power wielded by economic elites in nineteenth century Latin America include Prado Junior (1957), Perry (1978) and Graham (1990). Summerhill (1997) describes the retarded evolution of railroads in nieteenth century Latin America, while Marichal (1997) deals with obstacles to the development of financial markets. On the importance of these factors for nineteenth century US economic growth see Fogel (1964) for railroads, Timberlake (1993) for the financial system, and Goldin and Katz (1998) for education.

4 Concluding Comments

4.1 Incentive Compatibility

The tax scheme used in this paper has the drawback of not being incentive compatible. Some poor capitalists may be enticed to throw away their capital since they are better off becoming workers. We have written the model in this way for reasons of analytical tractability, but the results are preserved when one considers a more complex incentive compatible scheme.

A simple incentive compatible redistributive scheme would be one that taxed only capital and gave the subsidy both to workers and to capitalists. Given a tax rate of less than unity, even the poorest capitalist prefers being a capitalist to being a worker. Workers will still vote to optimize r, and capitalists will give political contributions whenever $\rho k_i > \frac{a\lambda}{\tau(\lambda-1)}$. All our results therefore follow identically.

Although the mathematics of this specification are formally identical, one must be careful with the meaning of $f(y)$, the distribution of income among capitalists. If capitalists pay taxes only when $\rho k_i < \frac{a\lambda}{\tau(\lambda-1)}$, then r would equal

$$r = \tau \int_0^{\frac{a\lambda}{\tau(\lambda-1)}} \rho k_i f(k_i) dk \qquad (14)$$

the amount of capital held by people for which their *capital* income is lower than the threshold. Thus whatever functional form we pick for $f(.)$ must now be an adequate representation of the distribution of *capital income* and not of the *income* *of capitalists*. This is particularly relevant when we discuss the Pareto specification, as we have argued that this is a good representation of the distribution of *income* in the upper tail of the distribution. If we want to keep to this argument, then $f(k)$ ought to be the distribution of capital income induced by a distribution of total (capital plus labor) income that follows the Pareto form.

Although the mathematics of the Pareto specification for this case become mathematically much more complex, it can be proven that the negative comparative statics effect of inequality on redistribution is preserved (see Appendix for details).

4.2 The Meltzer-Richard Hypothesis, Revenue Leakage, and Channels of Political Pressure

It may seem surprising that the effect of inequality on redistribution is always negative in our model. After all, didn't Meltzer and Richard (1981) prove that the median voter would always desire greater redistribution when inequality is greater? Shouldn't that effect at least partially offset our result?

The answer to this question requires understanding the particular assumptions behind Meltzer and Richard's results. As Rodríguez (1999a) has shown, the Meltzer-Richard hypothesis is largely driven by the restriction that the tax rate be linear in income or that voters are unable to target subsidies to themselves. If any of these assumptions is relaxed, as in our model, the Meltzer-Richard effect can easily be reversed.

Although we believe that targeted subsidies are more characteristic of the welfare state type redistributive programs which we want to study, our characterization was selected more than anything for reasons of expositional clarity. We could assume instead that workers are unable to target all of the subsidy to themselves. In that case they would receive only a fraction θ of revenues with the rest, $1-\theta$, captured by capitalists. For example, government redistributive policies could take the form of subsidies to consumption of essential goods which primarily benefits the poor but in part also subsidize the consumption of the rich. In that case the typical worker would have income:

$$\begin{aligned} & w(1-\tau)+\tau w\theta+\theta\gamma r \\ = \; & w+\theta\gamma r-\tau w(1-\theta) \end{aligned}$$

and thus workers would vote to maximize $v=\theta\gamma r-\tau w(1-\theta)$. The envelope theorem argument would now imply

$$\frac{dv}{d\sigma}=\frac{\partial v}{\partial\tau}\frac{\partial\tau}{\partial\sigma}+\frac{\partial v}{\partial\sigma}=\theta\delta\frac{\partial r}{\partial\sigma}-(1-\theta)\tau\frac{\partial w}{\partial\sigma} \tag{15}$$

(15) is composed of two effects. The first one is the effect that we have been studying, the partial effect of income inequality on $\int_w^{\frac{a\lambda}{\tau(\lambda-1)}}\tau y_i f(y_i)dy$. As $\theta\rightarrow 1$, we would

expect that this effect becomes dominant and inequality deteriorates redistribution. The second effect captures the traditional Meltzer-Richard channel through which inequality affects redistribution. As w falls when income inequality deteriorates, this effect is positive, and more inequality generates more redistribution. As $\theta \to 0$, (15) the standard Meltzer-Richard effect dominates and inequality increases redistribution. For intermediate values of θ, we have two effects, and which of them is stronger cannot be established without assumptions on the parameters of the system[36]. It is straightforward although messy to extend this argument to the case of the previous subsection in which there is a pure tax on capital and the subsidy is received by all individuals; in that case we would introduce the Meltzer-Richard effect by requiring workers to pay taxes on labor.

In this paper we have assumed away the Meltzer-Richard channel for reasons of simplicity. But to what extent it exists is an empirical question, which can only be answered by evaluating the sign of the correlation between inequality and redistribution. The failure of most empirical studies to find a relation between inequality and redistribution is suggestive that the effect we have described in this paper and the Meltzer-Richard effect may to a certain extent offset each other in the existing data.

[36]The equilibrium threshold will now be higher (the tax rate lower) than that implied by the first order condition of the Pareto problem in Section 2.1. Thus the proof that $\frac{\partial r}{\partial \sigma} < 0$ in that Section does not apply to this problem. However, it can be established that for the Pareto density it is still the case that $\frac{\partial r}{\partial \sigma} < 0$.

In other words, more unequal societies may experience greater demand for redistribution from voters because they have less to lose from higher taxes (the Meltzer-Richard effect). However, it may also become more difficult for voters to enact redistributive transfers because politicians are more liable to be bought by rich individuals.

4.3 Conclusions

This paper has suggested that we should not expect more unequal societies to redistribute more. Unequal societies are characterized by a greater capacity of its richer members to affect the state's policies in their favor. Increases in inequality translate into a greater share of resources in the hands of individuals with the capacity to extract fiscal favors from policymakers and thus redound is a decrease in the resources a society is able to devote to redistribution. In our model, the poor do not expropriate the rich not because they are worried about reducing the size of the pie, but because the rich have enough political power to keep a sizable portion of the pie for themselves. We have seen that this negative link between inequality and redistribution is preserved under a variety of functional specifications and assumptions about the tax schedule.

We have shown that our model can support a negative link between inequality and growth, similar to that observed in the data. This cannot happen if the main effect of taxes on growth is due to disincentives to invest. But if rent-seeking has a negative effect on investment, inequality may harm growth by expanding the scope for unproductive activities which pull resources away from productive investments. It is in this sense that inequality causes redistributive pressures that can hamper growth. And it is also in this sense that the basic intuition of models such as those by Alesina and Rodrik (1994) and Persson and Tabellini (1994) is preserved. Inequality generates political distortions which cause disincentives to capital accumulation. However, more unequal societies do not see a greater amount of resources devoted to helping the poor. Rather, those resources taken away from productive investments go either into the pockets of politicians or are wasted in unproductive profit-seeking activities. In other words, inequality allows policymakers to raise their bargaining power *vis-a-vis* capitalists and to thus extract more resources from them, by raising the percentage of income held by those who actually have to gain from entering into a bargain with the government.

This model has of course presented one explanation of what limits redistribution in contemporary capitalist societies. We do not claim that it is the only explanation, and our treatment of incentive considerations in Section 3 has been geared precisely towards examining to what extent our model's conclusions are qualified when it interacts with other factors. But our model has arisen from the realization that models that rely purely on incentive considerations tend to get the comparative statics results wrong when they are pitted against the data. We believe to have offered an alternative explanation which is simple, intuitive, and consistent with the empirical evidence.

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5 Appendix 1: Proofs of Propositions

5.1 Proposition 1

Proof. To characterize the Efficient Bargain, it is simply necessary to note that the individual rationality constraints of the agents are:

$$\begin{aligned}(w+\rho K_i)\varepsilon_i - C_i - a &\geq 0 \qquad (16)\\ -(w+\rho K_i)\varepsilon_i + \lambda C_i &\geq 0\end{aligned}$$

In order for them both to be satisfied it must be the case that:

$$C_i \in \left\{\frac{w+\rho K_i}{\lambda}\varepsilon_i, (w+\rho K_i)\varepsilon_i - a\right\} \qquad (17)$$

A necessary condition for (35) to be nonempty is $\frac{w+\rho K_i}{\lambda}\varepsilon_i \leq (w+\rho K_i)\varepsilon_i - a$, which can be expressed as:

$$w+\rho K_i \geq \frac{a\lambda}{(\lambda-1)\varepsilon_i}$$

It follows that, since $\varepsilon_i \leq \tau$ there will be no individual for which $w+\rho K_i < \frac{a\lambda}{(\lambda-1)\tau}$ for which there exists a bargain that fulfills the individual rationality conditions. Therefore individuals with income lower than $\frac{a\lambda}{(\lambda-1)\tau}$ will give no contributions and get no exemptions. Now when $w+\rho K_i \geq \frac{a\lambda}{(\lambda-1)\tau}$ there will always be a set of efficient bargains which (weakly) Pareto dominate the reservation utilities, and thus we shall expect $\varepsilon_i > 0$ in these cases.

It is left to establish that when $w + \rho K_i \geq \frac{a\lambda}{(\lambda-1)\tau}$ then a full exemption $\varepsilon_i = \tau$ is granted. To see this, we write down the utility possibilities frontier as the solution to:

$$\begin{aligned} \underset{\varepsilon_i, C_i}{Max} \left\{(w+\rho K_i)\varepsilon_i - C_i - a\right\} \text{ subject to } -(w+\rho K_i)\varepsilon_i + \lambda C_i &\geq \overline{u} \\ \varepsilon_i &\leq \tau \end{aligned}$$

Substituting the first constraint in the objective:

$$\underset{\varepsilon_i, C_i}{Max} \left\{(w+\rho K_i)\varepsilon_i - \frac{\overline{u}}{\lambda} - \frac{(w+\rho K_i)\varepsilon_i}{\lambda} - a\right\} \text{ subject to } \varepsilon_i \leq \tau$$

As $\lambda > 1$, the maximand is linear in ε_i, and thus $\varepsilon_i = \tau$. ■

5.2 Proposition 2

Proof. : To deal with changes in income distributions as transfers of income, let the income density at any income distribution be distributed as $y' = y + a(y, \sigma)$[37] $\sim h(y', \sigma)$ such that the percentage of people who receive incomes between $\overline{y}$ and $\overline{\overline{y}}$ before the transfer is the same as the proportion of people who receive incomes between $\overline{y} + a(\overline{y}, \sigma)$ and $\overline{\overline{y}} + a(\overline{\overline{y}}, \sigma)$ for any $\overline{y}, \overline{\overline{y}}$. Let $a(0, \sigma) = 0$. Therefore:

[37] $a(y, \sigma)$ should not be confused with the fixed cost from rent-seeking a.

$$\int_{\underline{y}}^{\overline{\overline{y}}} f(y)dy = \int_{\overline{y}+a(\overline{y},\sigma)}^{\overline{\overline{y}}+a(\overline{\overline{y}},\sigma)} h(y')dy'$$

Changing variables under the integral sign gives us:

$$\int_{\overline{y}}^{\overline{\overline{y}}} f(y)dy = \int_{\overline{y}}^{\overline{\overline{y}}} h(y + a(y,\sigma)) \left[1 + \frac{\partial a(y,\sigma)}{\partial y}\right] dy \forall \overline{y}, \overline{\overline{y}}$$

which implies that $h(y + a(y,\sigma)) = \frac{f(y)}{1+\frac{\partial a(y,\sigma)}{\partial y}}$. In other words, we write the income density h as the result of transferring $a(y,\sigma)$ units of income to a capitalist with income y from a baseline income density $f(y)$. We can write the net resource transfer as:

$$r = \tau \int_{w}^{y^*} (y')h(y')dy = \tau \int_{w}^{g(y^*,\sigma)} (y + a(y,\sigma))f(y_i)dy \tag{18}$$

where $y^* = \frac{\alpha\lambda}{\tau(\lambda-1)}$ and $g(y^*,\sigma)$ is defined implicitly from the equation $y + a(y,\sigma) = y^*$.

We define a transfer from a group A to a group B as a change in income distribution such that no individual in group A is better off as a result of the transfer and no individual in group B is worse off. That is, $\frac{\partial a(y_i,\sigma)}{\partial \sigma} < 0$ only if $i \in A$ and $\frac{\partial a(y_i,\sigma)}{\partial \sigma} > 0$ only if $i \in B$.

The envelope theorem argument from (11) applies identically to (**??**), and since the mean preserving spread among capitalists implies that $du_k = 0$, we can find the comparative statics effect of a change in σ on r' only by looking at the sign of $\frac{\partial r}{\partial \sigma}$. We can without loss of generality make $a(y, \sigma) = 0$ at the level of inequality at which we take derivatives. Taking derivatives and using the implicit function rule for $\frac{\partial g}{\partial \sigma}$, we find:

$$\frac{\partial r}{\partial \sigma} = \tau \left\{ \int_{w}^{y^*} \frac{\partial a(y, \sigma)}{\partial \sigma} f(y_i) dy - y^* f(y^*) \frac{\frac{\partial a(y^*, \sigma)}{\partial \sigma}}{1 + \frac{\partial a(y^*, \sigma)}{\partial y}} \right\} \tag{19}$$

A transfer from capitalists with income lower than y^* to individuals with income higher than or equal to y^* implies $\frac{\partial a(y,\sigma)}{\partial \sigma} < 0$ for $y < y^*$, and $\frac{\partial a(y^*,\sigma)}{\partial \sigma} \geq 0$. Therefore $\frac{\partial r}{\partial \sigma} < 0$, establishing our claim[38]. Using the mean preserving spread property, we can write the derivative as well as:

$$\frac{\partial r}{\partial \sigma} = \tau \left\{ - \int_{y^*}^{\infty} \frac{\partial a(y, \sigma)}{\partial \sigma} f(y_i) dy - y^* f(y^*) \frac{\frac{\partial a(y^*, \sigma)}{\partial \sigma}}{1 + \frac{\partial a(y^*, \sigma)}{\partial y}} \right\}$$

and use the same reasoning to derive the effect of a transfer from capitalists with income higher than y^* to those with income lower than or equal to y^*.

Now consider a transfer of income from workers which leaves untouched the distribution of income among capitalists, as measured by the Lorenz Curve of the income distribution. Let $h(.)$ denote the density function for post-transfer income distribution and $f(.)$ for the pre-transfer density. Let $y'(y)$ be defined implicitly by $H(y') = F(y)$. That is, y' is the level of income held by the person at the same percentile of the population which held y before the transfer. Remember that the first derivative of the

[38] Note that $1 + \frac{\partial a(y^*,\sigma)}{\partial y} > 0$ is necessary over any finite interval for $h(y')$ to be a proper density

Lorenz curve at percentile p is $\frac{y}{\mu_k}$and the second derivative is $\frac{1}{\mu_k f(y)}$, with $y = F^{-1}(p)$. Therefore if the pre-transfer and post-transfer Lorenz curves are identical, with k the ratio of post to pre-transfer μ_k, it means that $y' = ky$ and $h(y') = \frac{f(y)}{k}$. We can now write the effective tax rate on capital as:

$$r' = \frac{r}{\mu_k} = \frac{\tau \int_0^{y^*} y'h(y')dy'}{k\mu_k} \frac{\tau \int_0^{\frac{y^*}{k}} kyf(y)dy}{k\mu_k} = \frac{\tau \int_0^{\frac{y^*}{k}} yf(y)dy}{\mu_k}$$

with

$$\frac{\partial r'}{\partial k} = \frac{\tau}{\mu_k}\left\{-\left(\frac{y^*}{k}\right)^2 f(y^*)\right\} < 0$$

/ ■

5.3 Lemma 1

We solve the problem in two simple stages. First we characterize the levels of ε_i which will be on the contract curve. We can write the equation for the contract curve as:

$$\underset{\varepsilon_i}{Max}\left\{n_{0i}(w+\rho K_i)\varepsilon_i - \frac{\overline{U}}{\lambda} - \left(\frac{w+\rho K_i}{\lambda}\varepsilon_i\right)\right\}$$

Note that the maximand is increasing (decreasing) in ε_i when $n_{0i} > (<)\frac{1}{\lambda}$. Therefore any optimal contract must satisfy:

$$\begin{aligned} \varepsilon_i &= \tau \text{ if } n_{0i} > \frac{1}{\lambda} \\ \varepsilon_i &= 0 \text{ if } n_{0i} < \frac{1}{\lambda} \end{aligned}$$

The exemption level will be indeterminate for the case with $n_{0i} = \frac{1}{\lambda}$. As we show later, this will be an occurrence with mass zero, so we can ignore this knife-edge case. With $\varepsilon_i = 0$ the individual rationality constraint for the capitalist dictates $C_i = 0$.

Now we can characterize the outcome of the generalized Nash bargaining for $n_{0i} > \frac{1}{\lambda}$ solution as:

$$C_i = Arg \max \left\{ (1-\eta) \ln \left(n_{0i} y_i \tau - C_i \right) + \eta \ln \left(-y_i \tau + \lambda C_i \right) \right\}$$

with first order condition

$$-(1-\eta) \frac{1}{n_{0i} y_i \varepsilon_i - C_i} + \eta \frac{\lambda}{-y_i \varepsilon_i + \lambda C_i} = 0$$

which, after some algebra, reduces to:

$$C_i = \frac{1}{\lambda} \left[\eta (\lambda n_{0i} - 1) + 1 \right] y_i \tau$$

/ ■

5.4 Proposition 3

Maximizing (12) with respect to n_{0i} and manipulating the first-order condition gives us the optimal n_{0i} (provided a positive payoff) as:

$$C'^{-1} \left(y_i \tau \left(1 - \eta \right) \right) = n_{0i}^{*} \tag{20}$$

We can insert (**??**) in (12) to get:

$$V(y_i\tau) = C'^{-1}\left(y_i\tau\left(1-\eta\right)\right)y_i\tau - \frac{1}{\lambda}\left[\eta(\lambda C'^{-1}\left(y_i\tau\left(1-\eta\right)\right)-1)+1\right]y_i\tau - C(C'^{-1}\left(y_i\tau\left(1-\eta\right)\right)) \tag{21}$$

For political organization to take place, $V(y_i\tau) > 0$. If $C(.)$ is homogeneous of degree t then we know C' is homogeneous of degree $t-1$ and C'^{-1} is homogeneous of degree $\frac{1}{t-1}$. We can rewrite (**??**) being greater than zero as:

$$\begin{aligned}
V(y_i\tau) &= C'^{-1}\left((1-\eta)\right)(y_i\tau)^{\frac{t}{t-1}} - \eta C'^{-1}\left(1-\eta\right)(y_i\tau)^{\frac{t}{t-1}} && (22)\\
&\quad + \left(\frac{\eta}{\lambda}-\frac{1}{\lambda}\right)y_i\tau - (y_i\tau)^{\frac{t}{t-1}}C(C'^{-1}\left((1-\eta)\right)) && (23)\\
&> 0 && (24)
\end{aligned}$$

$$\left[C'^{-1}\left((1-\eta)\right) - \eta C'^{-1}\left(1-\eta\right) - C(C'^{-1}\left((1-\eta)\right))\right](y_i\tau)^{\frac{1}{t-1}} > \frac{(1-\eta)}{\lambda} \tag{25}$$

$$\left[(1-\eta)C'^{-1}\left((1-\eta)\right) - C(C'^{-1}\left((1-\eta)\right))\right](y_i\tau)^{\frac{1}{t-1}} > \frac{(1-\eta)}{\lambda} \tag{26}$$

if this inequality holds then $[(1-\eta)C'^{-1}\left((1-\eta)\right) - C(C'^{-1}\left((1-\eta)\right))] > 0$ and we can express it as

$$y_i\tau > (y_i\tau)^* = \left(\frac{(1-\eta)}{\lambda\left[(1-\eta)C'^{-1}\left((1-\eta)\right) - C(C'^{-1}\left((1-\eta)\right))\right]}\right)^{t-1} \tag{27}$$

note that the right hand side of the equation is completely a function of the parameters and the function $C(.)$.

Note also that at $(y_i\tau)^*$, $n_{0i}^* > \frac{1}{\lambda}$, as at $n_{0i} = \frac{1}{\lambda}$, $V(y_i\tau) < 0$ and (**??**) specifies that n_{0i}^* is an increasing function of $y_i\tau$. Using Lemma 1 the proposition is established./

■

6 Appendix 2: Examples and Selected Derivations

NOTE: This Appendix is intended to aid referees' evaluation and is not meant for publication

6.1 Examples

Example 1:

To see the effects that the mean to median ratio will have on r', we first calculate r. Integrating (10) and substituting in the density function, we get:

$$
\begin{aligned}
r &= \frac{1}{2}\frac{1}{\rho\overline{K}}\left(\tau(\rho\overline{K}+w)^2 - \tau w^2\right) \text{ if } \tau \leq \frac{a\lambda}{(\rho\overline{K}+w)(\lambda-1)} \\
&\quad \frac{1}{2}\frac{1}{\rho\overline{K}}\left(\frac{(a\lambda)^2}{\tau(\lambda-1)^2} - \tau w^2\right) \text{ otherwise}
\end{aligned}
$$

It is easy to see that r is maximized at $\tau^* = \frac{a\lambda}{(\rho\overline{K}+w)(\lambda-1)}$ (s is decreasing everywhere above τ^* and increasing everywhere below τ^*. Therefore the median voter will set $\tau = \tau^*$. Total tax collection will thus be:

$$r = \frac{1}{2}\frac{a\lambda}{(\lambda-1)}\left(1+\frac{1}{\frac{2}{\gamma}(m-1)+1}\right) \tag{28}$$

which is a decreasing function of m, the ratio of mean over median income. According to (**??**), increases in the ratio of mean to median income will lower the average tax burden. As capitalists' income rises with a mean-preserving spread in the mean to median ratio, then it follows that the effective redistributive tax rate r' also goes down when m rises, holding fixed the level of GNP per capita. A similar prediction holds with respect to changes in the variance of income distribution among capitalists[39]. The *nominal* tax rate also falls with mean-preserving increases in the mean to median ratio[40] under the uniform case. The tax/GDP ratio $(\frac{\tau w+r}{w+\frac{1}{2}\rho\overline{K}})$ also falls, as does the Transfer/GDP ratio $(\frac{r}{w+\frac{1}{2}\rho\overline{K}})$.

Example 2 :

If the Pareto form describes the distribution of income among capitalists, pre-tax income will be $y_l = w$ for workers and $y_k^i = w + \rho K_i$ for capitalist i, where y_k^i is distributed with density

[39]The reason for this is that the uniform distribution, as well as the two-parameter Pareto distribution we consider next, specify three ratios (the mean to median ratio, per capita gnp, and income distribution among capitalists) as a function of two parameters. Thus mean preserving deteriorations in the mean to median ratio imply changes in the variance of income distribution, and viceversa.

[40]This is because a mean-preserving spread implies $dw = -\gamma r d\overline{K}$, implying $dr\overline{K} + dw > 0 \Rightarrow d\tau^* > 0$.

$$f(y) = \alpha w^{\alpha} y^{-\alpha-1} \text{ for } y > w$$

$$0 \text{ otherwise}$$

Capitalist's average income will be $\frac{\alpha}{\alpha-1}w$, so that mean income will be $\mu = w1 + \gamma' \frac{1}{\alpha-1}$, where $\gamma' = \frac{\gamma}{\gamma+1} \in (0, .5)$ is the ratio of capitalists over the population. The mean to median ratio will thus be $m = 1 + \gamma' \frac{1}{\alpha-1}$, and the Gini coefficient for capitalists' income distribution will be[41] $G_k = \frac{1}{2\alpha-1}$. Capital's share of income will be $\frac{\alpha}{\alpha-1}\gamma$. Thus we see that α is a measure of the equality of income distribution. As α goes up, the distribution of income becomes more equal: the Gini coefficient falls and so do the ratio of mean to median income and capital's share of income. We will look at the effect of a mean preserving increase in inequality, that is $d\alpha < 0$, $d\mu = 0$.

Substituting the density function in (10) and integrating, we get

$$r = \frac{aw\alpha}{(\lambda-1)(\alpha-1)} \frac{1}{X} \left(1 - \left(\frac{X}{w}\right)^{1-\alpha}\right) \tag{29}$$

with $X = \frac{a\lambda}{(\lambda-1)\tau}$, a convenient transformation of the tax rate. Maximizing with respect to X and manipulating gives us a first-order condition:

[41] The Gini coefficient for the distribution of income among all individuals is $\sqrt{2}(1-\gamma)(1-\frac{1}{1+\frac{\gamma}{\alpha-1}})+$ $\frac{1}{2\alpha-1}\gamma\left(1-(1-\gamma)\frac{1}{1+\frac{\gamma}{\alpha-1}}\right)$

which is a decreasing function of α.

$$\frac{X}{w} = \alpha^{\frac{1}{\alpha-1}} \tag{30}$$

Remember that by the envelope theorem $\frac{\partial r}{\partial \tau} = 0$, and thus $\frac{\partial r'}{\partial \tau} = 0$. Thus we can concentrate on studying the effect of a mean preserving change in a and w on r' through the study of its partial derivative:

$$dr' = \frac{\partial r'}{\partial \alpha} d\alpha + \frac{\partial r'}{\partial w} dw$$

Substituting (**??**) into the definition of r', differentiating,and using the restriction on dw implied by $d\alpha < 0$, $d\mu = 0$, we get:

$$\frac{dr'}{d\alpha} = \frac{\tau}{\alpha}\left(\frac{1}{\alpha-1}\ln\alpha - \frac{\gamma}{(\alpha-1+\gamma)}\right) \tag{31}$$

This expression is always positive[42], establishing that the effective redistributive tax rate will always fall with inequality.

Straightforward calculus and use of (**??**) also helps establish that:

$$\frac{d\tau}{d\alpha} = -\frac{\tau}{(\alpha-1)^2}\left[\frac{(\alpha-1)\gamma}{(\alpha-1+\gamma)} - \ln(\alpha) + \frac{(\alpha-1)}{\alpha}\right] \tag{32}$$

Finally, we establish that under the Pareto density, the nominal tax rate has a unique minimum in inequality. First we prove that $X = \frac{a\lambda}{(\lambda-1)\tau}$ has a unique maximum. To see this, note that

[42] That this expression must be positive can be confirmed by noting that the second term inside the parentheses is $\frac{\gamma}{(\alpha-1+\gamma)} = \frac{1}{\frac{\alpha-1}{\gamma}+1} = \frac{1}{\alpha+(\alpha-1)(\frac{1}{\gamma}-1)} < \frac{1}{\alpha}$. But $\ln\alpha > \frac{\alpha-1}{\alpha}$ for $\alpha > 1$.

$$\frac{dX}{d\alpha} = \frac{X}{(\alpha-1)^2}\left(\frac{\gamma(\alpha-1)}{\alpha-1+\gamma} + \frac{\alpha-1}{\alpha} - \ln\alpha\right)$$

Call the expression in brackets $g(\alpha,\gamma) = \left(\frac{\gamma(\alpha-1)}{\alpha-1+\gamma} + \frac{\alpha-1}{\alpha} - \ln\alpha\right)$. $g(\alpha,\gamma)$ is zero at $\alpha = 1$, but has at that point a positive first derivative, so it is positive at $\alpha + \delta$ for sufficiently small δ. As $\alpha \to \infty$, it tends to $-\infty$. Since it is continuous, it must become zero for some $\alpha > 1$. As it is positive at $\alpha = 1 + \delta$, then it has an interior maximum before it becomes zero. This is the only maximum, as its second derivative:

$$\frac{\partial^2}{\partial\alpha^2}g(\alpha,\gamma) = \frac{1}{\alpha^2} - \frac{2}{\alpha^3} - \frac{2\gamma^2}{(\alpha-1+\gamma)^3} = -\frac{1}{\alpha^2} - \frac{2}{\alpha}\left[\frac{\gamma^2}{(\alpha-1+\gamma)^2}\left(-1+\frac{\alpha}{\alpha-1+\gamma}\right)\right] < 0$$

when

$$\frac{\partial}{\partial\alpha}g(\alpha,\gamma) = \frac{\gamma^2}{(\alpha-1+\gamma)^2} + \frac{1}{\alpha^2} - \frac{1}{\alpha} = 0 \tag{33}$$

Since it has a unique maximum at a positive $g(\alpha,\gamma)$, then when $g(\alpha,\gamma) = 0$ it must hold that $\frac{\partial g(\alpha,\gamma)}{\partial\alpha} < 0$. Now we can write the second order condition as:

$$\frac{d^2X}{d\alpha^2} = \frac{X}{(\alpha-1)^2}\left(\frac{\partial g(\alpha,\gamma)}{\partial\alpha}\right) - \frac{\partial\frac{X}{(\alpha-1)^2}}{\partial\alpha}g(\alpha,\gamma) < 0$$

when

$$\frac{dX}{d\alpha} = \frac{X}{(\alpha-1)^2}g(\alpha,\gamma) = 0$$

Now if $X(\alpha)$ has a maximum at $\alpha = \alpha^*$ it must be that $\tau(\alpha) = \frac{a\lambda}{(\lambda-1)X}$ has a minimum at $\alpha = \alpha^*$, as $\tau'(\alpha^*) = -\frac{a\lambda}{(\lambda-1)X^2}X'(\alpha^*) = 0$, and $\tau''(\alpha^*) = -\frac{a\lambda}{(\lambda-1)X^2}X''(\alpha^*) + \frac{2a\lambda}{(\lambda-1)X^3}\left(X'(\alpha^*)\right)^2 = 0$. ■

Some not very interesting algebra also establishes that the transfer to GDP ratio $\frac{\gamma r}{w+\gamma\mu_k}$ and the Tax/GDP ratio $\frac{\tau w+\gamma r}{w+\gamma\mu_k}$both fall with increases in income inequality. Figures 1 and 2 summarize the behavior of the relevant variables under the uniform and Pareto distribution.

6.2 Derivation of Selected Results

Claim: *Let the equilibrium contribution be a linear function of $y_i\tau$. Then if politicians control the tax rate $\frac{\partial\tau}{\partial\sigma} = 0$.*

Proof. First note that if $C_i = \xi y_i \tau$ then since the individual rationality constraint for the policymaker requires $C_i > \frac{y_i}{\lambda}\tau$ it must be that $\xi > \frac{1}{\lambda}$.Now note that politicians will set the tax rate to maximize

$$U_{pol} = w + \gamma \int_w^{\frac{a\lambda}{\tau(\lambda-1)}} \tau y f(y)dy + \lambda\ \gamma \int_{\frac{a\lambda}{\tau(\lambda-1)}}^{\infty} \xi y_i \tau f(y)dy \qquad (34)$$

$$= w + \gamma \int_w^{\infty} \tau y f(y)dy + \ \gamma \int_{\frac{a\lambda}{\tau(\lambda-1)}}^{\infty} \left[\xi - \frac{1}{\lambda}\right] y_i \tau f(y)dy \qquad (35)$$

The derivative of this term with respect to τ is:

$$w+\gamma\int_{w}^{\infty} yf(y)dy+\ \gamma\int_{\frac{a\lambda}{\tau(\lambda-1)}}^{\infty}\left[\xi-\frac{1}{\lambda}\right]y_i f(y)dy+\frac{a\lambda}{\tau^2(\lambda-1)}\left[\xi-\frac{1}{\lambda}\right]\frac{a\lambda}{\tau(\lambda-1)}\tau f(\frac{a\lambda}{\tau(\lambda-1)})>0$$

as $\xi>\frac{1}{\lambda}$. Therefore the utility of politicians is increasing in the tax rate and the equilibrium tax rate is set to $\tau=1$. This proves the claim. ■■

Claim: *Let the totality of the surplus of the bargain between policymakers and capitalists be captured by capitalists. Then if politicians control the tax rate* $\frac{\partial\tau}{\partial\sigma}=0$.

Proof. In this case contributions will equal $C_i=(w+\rho k_i)\tau-a$. Therefore politicians will set τ to maximize

$$\begin{aligned}
U_{pol} &= w+\gamma\int_{w}^{\frac{a\lambda}{\tau(\lambda-1)}}\tau yf(y)dy+\lambda\ \gamma\int_{\frac{a\lambda}{\tau(\lambda-1)}}^{\infty}y_i\tau f(y)dy-\ \lambda\gamma\int_{\frac{a\lambda}{\tau(\lambda-1)}}^{\infty}af(y)dy \\
&= w+\gamma\int_{w}^{\infty}\tau yf(y)dy+(\lambda-1)\ \gamma\int_{\frac{a\lambda}{\tau(\lambda-1)}}^{\infty}y_i\tau f(y)dy-\ \lambda\gamma\int_{\frac{a\lambda}{\tau(\lambda-1)}}^{\infty}af(y)dy
\end{aligned}$$

the first derivative with respect to τ is:

$$\begin{aligned}
&= \gamma\int_{w}^{\infty}yf(y)dy+(\lambda-1)\ \gamma\int_{\frac{a\lambda}{\tau(\lambda-1)}}^{\infty}y_i f(y)dy \\
&\quad +(\lambda-1)\gamma\frac{a\lambda}{\tau(\lambda-1)}\tau f(\frac{a\lambda}{\tau(\lambda-1)})\frac{a\lambda}{\tau^2(\lambda-1)} \\
&\quad -\lambda\gamma af(\frac{a\lambda}{\tau(\lambda-1)})\frac{a\lambda}{\tau^2(\lambda-1)}
\end{aligned}$$

$$= \gamma\int_{w}^{\infty}yf(y)dy+(\lambda-1)\ \gamma\int_{\frac{a\lambda}{\tau(\lambda-1)}}^{\infty}y_i f(y)dy$$

$$
\begin{aligned}
&+\frac{a\lambda}{\tau^2(\lambda-1)}\left[\lambda\gamma a f(\frac{a\lambda}{\tau(\lambda-1)})-\lambda\gamma a f(\frac{a\lambda}{\tau(\lambda-1)})\right]\\
=&\ \gamma\int_{w}^{\infty} yf(y)dy+(\lambda-1)\ \gamma\int_{\frac{a\lambda}{\tau(\lambda-1)}}^{\infty} y_i f(y)dy>0
\end{aligned}
$$

Again the utility of politicians is increasing in the tax rate and the equilibrium tax rate is set to $\tau = 1$. This proves the claim. ■ ■

Claim: *The gap between the nominal and effective tax rate is increasing in inequality.*

Proof. Combining (**??**) with (**??**) we get:

$$\frac{d(\tau-r')}{d\alpha}=\frac{\tau}{\alpha}\left\{\frac{1}{(\alpha-1)^2}\left[-\frac{\gamma(\alpha-1)}{(\alpha-1+\gamma)}-\alpha+\ln(\alpha)+1\right]\right\}$$

The expression in brackets is zero at $\alpha = 1$. But its derivative with respect to α is:

$$-\left(\frac{\gamma}{\alpha-1+\gamma}\right)^2+\frac{1}{\alpha}-1<0 \text{ for } \alpha>1$$

which establishes that

$$\frac{d(\tau-r')}{d\alpha}\leq 0$$

■

Claim: *Total fixed costs are increasing in inequality.*

Proof. Using the first-order condition (**??**)

$$1 - F(X^*) = \left(\frac{w}{X^*}\right)^{\alpha} = \alpha^{-\frac{\alpha}{\alpha-1}}$$

Taking derivatives

$$\frac{d(1 - F(X^*))}{d\alpha} = \frac{\alpha^{-\frac{\alpha}{\alpha-1}}}{(\alpha-1)^2}\left[\ln\alpha - (\alpha - 1)\right] < 0$$

■

Claim: *Redistribution is decreasing in inequality under the incentive compatible scheme.*

Proof.

Consider an income distribution in which $y = k + w \sim h(y) = P(w, \alpha)$. Then k should be distributed with density $f(k) = h(k + w)$ and

$$\int_0^X k_i f(k_i) dk = \int_0^X k_i h(k_i + w) dk = \int_w^{X+w} (y_i - w) h(y_i) dy_i \tag{36}$$

for $X = \frac{a\lambda}{(\lambda-1)\tau}$. Analysis of the comparative statics of r under the Pareto form is complicated by the fact that the first order condition can only be solved by solving a polynomial of degree $\alpha+1$, which lacks a closed form solution for X. Fortunately,one can express the equilibrium r as a function of α which is uniquely defined up to a constant.

We look for a maximum of:

$$\begin{aligned} r &= \tau \int_X^{X+w} (y-w)\alpha w^\alpha y^{-\alpha-1} dy \\ &= \frac{\alpha\lambda w}{(\lambda-1)X} \left\{ \frac{1}{\alpha-1} - \frac{\alpha}{\alpha-1}\left(\frac{X+w}{w}\right)^{1-\alpha} + \left(\frac{X+w}{w}\right)^{-\alpha} \right\} \end{aligned} \tag{37}$$

Taking the first order condition of (**??**), after some tedious algebra, one can express the solution for X in terms of a polynomial of degree $\alpha+1$:

$$g(\theta) = \theta^{\alpha+1} - \theta^2\alpha^2 + \theta(\alpha-1)(1+2\alpha) - \alpha(a-1) = 0 \tag{38}$$

By Descartes' Law, $g(\theta)$ has either one or three positive zeros, and since $g(1) = g'(1) = 0$, two of them are at $\theta = 1$. Since $g''(1) < 0$ for $\alpha > 1$, and $\underset{\theta\to\infty}{Lim}\, g(\theta) = +\infty$, the third zero must be at $\theta > 1$. Therefore (**??**) has a unique solution[43]. Define this

[43] When α is not an integer, the argument is more complex, but it goes through as long as $\alpha+1$ is rational. $g(\theta)$ can then be transformed into a polynomial $c(q)$ for $q = \theta^{\frac{1}{n}}$, where n is the lowest integer such that $\alpha + 1 = \frac{m}{n}$ for some integer m. $c(q)$ has the same number of sign changes as $g(\theta)$, and thus has the same number of positive zeros. As $c'(1) = 0$, two of them are at $q = \theta = 1$. $g'(1) = 0$, $g'(1) < 0$ and $\underset{\theta\to\infty}{Lim}\, g(\theta) = +\infty$ still establish that this third zero is at $\theta, q > 1$

solution as $\theta(\alpha)$

Lack of a closed form solution for X severely impairs the possibility of doing comparative statics. Fortunately, one can express the equilibrium r as a function of $\theta(\alpha)$:

$$r = \frac{a\lambda}{\lambda - 1} \frac{1}{(\theta(\alpha) - 1)(\alpha - 1)} \left\{1 - \alpha\theta(\alpha)^{1-\alpha} + \theta(\alpha)^{-\alpha}\right\}$$

therefore $r(\alpha)$ is uniquely defined up to a constant.

Figure A-1 plots r as a function of α, confirming that r increases with α and thus decreases with inequality. As a mean-preserving spread causes a rise in μ_k, then the effective redistributive tax rate also decreases with inequality.

Insert Figure A-1 here ■

Figure 1: Taxes, Transfers and Inequality under Uniform Distribution

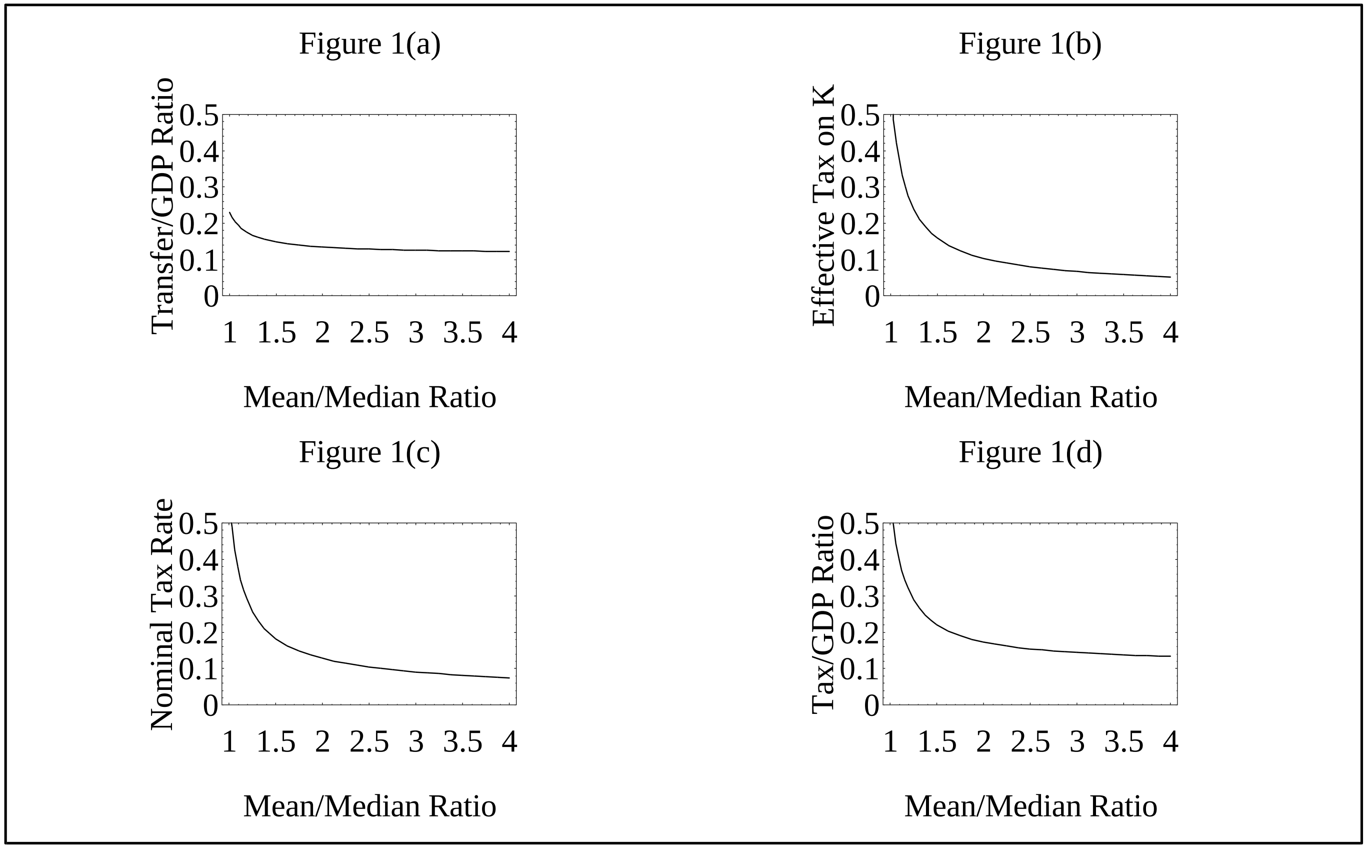

Figure 2: Taxes, Transfers and Inequality under Pareto Distribution

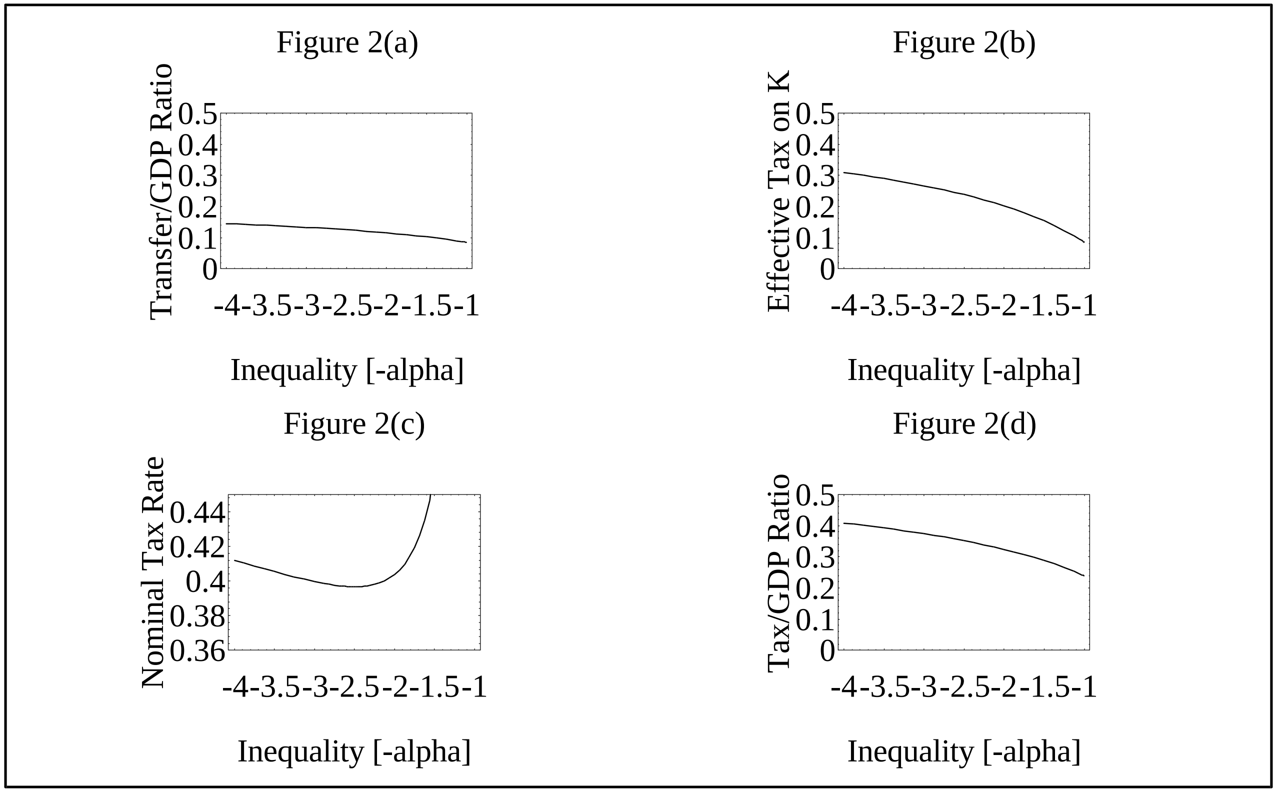

Figure A-1:Taxation and Inequality under Incentive Compatible Scheme